DETAILED ACTION

1.   A request for continued examination under 37 CFR 1.114, including the

fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection.

Since this application is eligible for continued examination under 37 CFR 1.114,

and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the

previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on July 14, 2010 has been entered.

Information Disclosure Statement

2.   The Information Disclosure Statements filed on March 20, 2009 has been

considered.

        The Office acknowledges receipt of the Information Disclosure Statement

filed on March 20, 2009. It has been placed in the application file and the

information refereed to therein has been considered by the examiner.

3.   Applicant's amendment dated July 14, 2010, responding to the Advisory

Action mailed January 20, 2010, the Notice of Appeal filed December 14, 2009,

the after-final amendment dated August 17, 2009, and Final Office action mailed

June 12, 2009 respectively provided in the rejection of claims 1-23, wherein

claims 1, 8, 12, 13, 15, 17, 19, and 22 have been amended.

EXAMINER'S AMENDMENT

4.   An examiner's amendment to the record appears below. Should the

changes and/or additions be unacceptable to applicant, an amendment may be

filed as provided by 37 CFR 1.312. To ensure consideration of such an

amendment, it MUST be submitted no later than the payment of the issue fee.

5.   Authorization for this examiner's amendment was given in a telephone

interview with Ms. Ann M. McCrackin (Reg. No. 42,858) on September 16, 2010

to further amend claims 1, 8, 12, 13, 15, 17, 19, and 22 (see Examiner's

Amendment below) and thus to obviate any potential 35 U.S.C 101 and/or 35

U.S.C 112, second paragraph issues and to place the claims in the condition for

allowance.

6.   The application has been amended as follows:

IN THE CLAIMS,

Please amend claims 1, 8, 12, 13, 15, 17, 19, and 22 as follows:

1.   (Currently Amended) An apparatus comprising:

a processing unit of a processor;

a memory coupled to the processor; and

an instruction set operable on the processing unit of the processor and including instructions:

　　　to instantiate a data structure in the memory to collect a representation of a working set; and

　　　~~defining~~ to define a hash unit operable on the processing unit to map a plurality of working set elements into the data structure using a hash function,

　　　wherein, in a program, [[a]] the working set $W(t_i, \tau)$ for $i=1,2\ldots$, where i is an integer, is a set of distinct memory segments $\{s_1, s_2 \ldots s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

　　　wherein the window is a sequence of τ consecutive memory accesses;

　　　wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

2.   (Previously Presented) The apparatus of claim 1 wherein the data structure is a 2^n x m bit table, where *n* is a number of bit table entries and m is a width of the bit table.

3.   (Original) The apparatus of claim 2 wherein m is in the range of 1 to 64.

4.   (Original) The apparatus of claim 2 wherein m = 1.

5.   (Original) The apparatus of claim 2 wherein n is in the range of 1 to 20.

6.   (Original) The apparatus of claim 1 wherein the data structure is a 2^n -bit vector.

7.   (Original) The apparatus of claim 6 wherein n = 1.

8.   (Currently Amended) A computerized method of creating a representation of a working set, the computerized method comprising:

        mapping a plurality of working set elements into fields of a data structure using a hash function,

        wherein, in a program, the working set $W(t_i, \tau)$ for i=1,2..., where i is an integer, is a set of distinct memory segments $\{s_1, s_2...s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

        wherein the window is a sequence of τ consecutive memory accesses;

        wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

9.   (Original) The computerized method of claim 8 wherein the mapping is performed for a fixed interval of program execution.

10.   (Original) The computerized method of claim 9 wherein the data structure is reset prior to each fixed interval of program execution.

11.   (Original) The computerized method of claim 10 further comprising saving the fields of the data structure prior to resetting the data structure.

12.   (Currently Amended) A computerized method of creating a representation of a working set, the computerized method comprising:

executing a program for a fixed interval, the program comprising instructions identified by a program counter;

performing a hash function on the program counter to create a hash value for each instruction executed during the fixed interval; and

updating a field of a table indexed by the hash value wherein the table represents the working set,

wherein, in a second program, the working set $W(t_i, \tau)$ for i=1,2…, where i is an integer, is a set of distinct memory segments $\{s_1, s_2…s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

wherein the window is a sequence of τ consecutive memory accesses;

wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

13.   (Currently Amended) A computer system comprising:

a bus;

a memory coupled to the bus; and

a processor coupled to the memory and the bus; the processor comprising:

a data structure to collect a representation of a working set; and

a hash unit to map a plurality of working set elements into the data structure using a hash function,

wherein, in a program, the working set $W(t_i, \tau)$ for i=1,2…, where i is an integer, is a set of distinct memory segments $\{s_1, s_2…s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

wherein the window is a sequence of τ consecutive memory accesses;

wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

14.   (Previously Presented) The computer system of claim 13, further
comprising:

      an instruction retirement unit; and

      wherein the data structure and the hash unit are part of an instruction
retirement unit.

15.   (Currently Amended) A computerized method of estimating size of a
working set, the method comprising:

      receiving a signature for a working set; and

      estimating the size of the working set based on the size of the signature,
wherein, in a program, the working set $W(t_i, \tau)$ for i=1,2..., where i is an
integer, is a set of distinct memory segments $\{s_1, s_2...s_\omega\}$ accessed over the ith
window of size τ within a time interval t_i;

      wherein the window is a sequence of τ consecutive memory accesses;

      wherein the working set size is ω, the cardinality of the set of unique
segments that are accessed by members of the window.

      .

16.   (Original) The computerized method of claim 15 wherein the estimating is
performed with the following function:

$$K = \log(1-f)/\log\left(1-\frac{1}{2^n}\right),$$

wherein K is the number of unique working set elements, 2^n is the number of
entries in the signature, and f is the fraction of 1's in the signature.

17.   (Currently Amended) A computerized method of detecting working set
changes, the method comprising:

      comparing a current working set signature to a previous working set
signature;

calculating a relative signature distance between the current working set signature and the previous working set signature; and

identify a working set change when the relative signature distance exceeds a predetermined threshold,

wherein, in a program, [[a]] the working set $W(t_i, \tau)$ for i=1,2..., where i is an integer, is a set of distinct memory segments $\{s_1, s_2...s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

wherein the window is a sequence of τ consecutive memory accesses;

wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

.

18.   (Original) The computerized method of claim 17 wherein the working set change indicates a phase change in a program.

19.   (Currently Amended) A computerized method of identifying a recurring working set, the method comprising:

comparing a current working set signature to one or more previous working set signatures;

calculating a relative signature distance between the current working set signature and the one or more previous working set signatures; and

identifying a recurring working set when the relative signature distance between the current working set signature and one of the previous working set signatures is within a predetermined threshold,

wherein, in a program, [[a]] the working set $W(t_i, \tau)$ for i=1,2..., where i is an integer, is a set of distinct memory segments $\{s_1, s_2...s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

wherein the window is a sequence of τ consecutive memory accesses;

wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

20.   (Original) The computerized method of claim 19 further comprising identifying a new working set when the relative signature distance between the current working set signature the one or more previous working set signatures exceeds a predetermined threshold.

21.   (Original) The computerized method of claim 20 further comprising maintaining a table of the one or more previous working set signatures.

22.   (Currently Amended) A hardware reconfiguration method comprising:

   maintaining a table comprising a plurality of working set signatures for a program;

   upon detecting a working set change, looking up a working set signature for a current working set in the table;

   if the working set signature is in the table, reinstating a hardware configuration for the current working set; and

   if the working set signature is not in the table; identifying a new hardware configuration for the current working set and saving the working set signature and the new hardware configuration,

   wherein, in a program, [[a]] the working set $W(t_i, \tau)$ for i=1,2..., where i is an integer, is a set of distinct memory segments $\{s_1, s_2...s_\omega\}$ accessed over the ith window of size τ within a time interval t_i;

   wherein the window is a sequence of τ consecutive memory accesses;

   wherein the working set size is ω, the cardinality of the set of unique segments that are accessed by members of the window.

23.   (Original) The method of claim 22 wherein the working set change indicates a phase change in a program.

   -   **END OF AMENDMENT –**

Allowable Subject Matter

7.   Claims 1-23 are allowed.

8.   The followings are an examiner's statement of reasons for allowance:

(i) The cited prior art taken alone or in combination fails to suggest

"…

        to instantiate a data structure in the memory to collect a

representation of a working set; and

        to define a hash unit operable on the processing unit to map a

plurality of working set elements into the data structure using a hash

function,

        wherein, in a program, the working set $W(t_i, \tau)$ for i=1,2…, where i is

an integer, is a set of distinct memory segments $\{s_1, s_2 \ldots s_\omega\}$ accessed

over the ith window of size τ within a time interval t_i;

        wherein the window is a sequence of τ consecutive memory

accesses;

        wherein the working set size is ω, the cardinality of the set of

unique segments that are accessed by members of the window …", as

recited in independent claims 1 and similarly recited in independent claims

8, 12 and 13.

(ii) The cited prior art taken alone or in combination fails to suggest

"… estimating size of a working set … comprising:

        receiving a signature for a working set; and

estimating the size of the working set <u>based on the size of the</u> <u>signature</u>,

wherein, in a program, <u>the working set W(t$_i$, τ) for i=1,2…, where i is an integer, is <u>a set of distinct memory segments</u> {s$_1$, s$_2$…s$_\omega$} accessed <u>over the ith window of size τ within a time interval t$_i$;</u>

wherein the window is <u>a sequence of τ consecutive memory accesses</u>;

wherein the working set size is ω, <u>the cardinality of the set of unique segments</u> that are accessed by members of the window.", as recited in independent claim 15.

(iii) The cited prior art taken alone or in combination fails to suggest

"… <u>detecting working set changes</u> … comprising:

comparing <u>a current working set signature</u> to <u>a previous working set signature</u>;

calculating <u>a relative signature distance</u> between the current working set signature and the previous working set signature; and

identify <u>a working set change</u> when the relative signature distance exceeds <u>a predetermined threshold</u>,

wherein, in a program, <u>the working set W(t$_i$, τ) for i=1,2…, where i is an integer, is <u>a set of distinct memory segments</u> {s$_1$, s$_2$…s$_\omega$} accessed <u>over the ith window of size τ within a time interval t$_i$;</u>

wherein the window is <u>a sequence of τ consecutive memory accesses</u>;

wherein the working set size is ω, <u>the cardinality of the set of unique segments</u> that are accessed by members of the window", as recited in independent claim 17.

(iv) The cited prior art taken alone or in combination fails to suggest

"… <u>identifying a recurring working set</u> …comprising:

comparing <u>a current working set signature</u> to one or more <u>previous working set signatures</u>;

calculating <u>a relative signature distance</u> between the current working set signature and the one or more previous working set signatures; and

identifying <u>a recurring working set</u> when the relative signature distance between the current working set signature and one of the previous working set signatures is <u>within a predetermined threshold</u>,

wherein, in a program, <u>the working set $W(t_i, \tau)$ for i=1,2…, where i is an integer, is <u>a set of distinct memory segments</u> $\{s_1, s_2…s_\omega\}$ accessed over the i<u>th</u> window of size τ within a time interval t_i;

wherein the window is <u>a sequence of τ consecutive memory accesses</u>;

wherein the working set size is ω, <u>the cardinality of the set of unique segments</u> that are accessed by members of the window.", as recited in independent claims 19.

(v) The cited prior art taken alone or in combination fails to suggest

"<u>A hardware reconfiguration</u> … comprising:

maintaining a table comprising <u>a plurality of working set signatures</u> for a program;

upon <u>detecting a working set change</u>, looking up a working set signature for a current working set in the table;

<u>if the working set signature is in the table</u>, <u>reinstating</u> a hardware configuration for the current working set; and

<u>if the working set signature is not in the table</u>; <u>identifying</u> a new hardware configuration for the current working set and saving the working set signature and the new hardware configuration,

wherein, in a program, <u>the working set W</u>(t_i, τ) for i=1,2..., where i is an integer, is <u>a set of distinct memory segments</u> {s_1, $s_2...s_\omega$} accessed <u>over the i<u>th</u></u> <u>window of size τ within a time interval t_i</u>;

wherein the window is <u>a sequence of τ consecutive memory accesses</u>;

wherein the working set size is ω, <u>the cardinality of the set of unique</u> <u>segments</u> that are accessed by members of the window.", as recited in independent claims 22.

9.   Claims (2-7), (9-11), (14), (16), (18), (20, 21), and (23) are considered allowable by virtue of their dependence on allowable independent claims 1, 8, 13, 15, 17, 19, and 22 respectively.

10.   Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

11.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben C. Wang whose telephone number is (571) 270-1240. The examiner can normally be reached on 8:00-5:30 (EST/EDT), Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax

phone number for the organization where this application or proceeding is

assigned is 571-273-8300. Information regarding the status of an application may

be obtained from the Patent Application Information Retrieval (PAIR) system.

Status information for published applications may be obtained from either Private

PAIR or Public PAIR. Status information for unpublished applications is available

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(toll-free). If you would like assistance from a USPTO Customer Service

Representative or access to the automated information system, call 800-786-

9199 (IN USA OR CANADA) or 571-272-1000.

/Ben C Wang/   /Michael J. Yigdall/
Examiner, Art Unit 2192   Primary Examiner, Art Unit 2192